SHEAR FRAGMENTING BULLET

Technical Field

The present invention relates to firearm ammunition and more particularly to a jacketed bullet that shear fragments on impact and a method of making the bullet.

Background Art

It is desirable for a bullet to have good flight performance, including good range and accuracy, and limited penetration ability. The depth of bullet penetration is directly proportional to velocity and size. Bullets that fragment prior to impact or immediately upon impact have limited penetration ability. Such bullets have little or no path of travel after impact, and therefore will not ricochet or pass through the intended target and strike an unintended target. However, bullets that fragment or disintegrate before impact may not be able to achieve desire flight performance.

U.K. Patent No. 11,087 to Weiss discloses a hollow base bullet with a mantle and a core pressed into the mantle through an open posterior end. The mantle is weakened by grooves in the anterior end. The core is a single solid leaden piece with incisions therein, or several twisted pieces of lead wire. Wiess states that the disclosed bullet will pass through a target and burst on impact with a hard body.

U.S. Patent No. 122,620 to Maduell discloses an unjacketed bullet having four interlocking segments. The segments of Maduell would separate upon firing, and prior

to impact, from a rifled firearm barrel due to centrifugal force.

U.S. Patent No. 3,208,386 to Schneider et al. discloses a bullet having several elongated metal segments with the ends of the segments fitted into a base cup, and the segments are then swaged to form the desired bullet shape. The bullet of Schneider et al. separates upon firing and prior to impact due to centrifugal force to provide a shotgun type pattern.

U.S. Patent No. 5,569,874 to Nelson discloses a bullet having a larger central copper wire and several smaller copper wires around the central wire, with the tail ends of the wires swaged into a jacket. After impact the tip ends of the wires separate while the tail ends of the wire are retained in the jacket.

U.S. Patent 5,528,989 to Briese discloses a bullet having a jacket and a leaden core with the core being formed by swaging a plurality of straight wires into a cylinder. The wires, after swaging, interlock with each wire having end sections that extend parallel to the longitudinal axis of the core. Each wire has a kinked intermediate section that includes two oblique sections, the oblique sections connecting together and each oblique section connecting to an end section.

U.S. Patent 5,679,920 to Hallis et al. discloses a bullet with a copper jacket and a core of segments of zinc, iron, steel or copper. The core is created by forming a hollow roll or cylinder of twisted wires, and work hardening the wires by high impact swaging to make the wires brittle. The wires in the core after swaging are distorted and have an interlocking pattern similar to the pattern disclosed in U.S. Patent

5,528,989 to Briese, and are not arranged helically. The disclosed bullet fragments upon impact with a hard barrier such as a sheet of metal.

U.S. Patent 5,582,255 to Hallis et al. discloses a bullet with a copper jacket and a core having wires of zinc, iron, steel or copper. The core includes heart having a plurality of wires extending parallel to the longitudinal axis of the core and a plurality of wires twisted around the heart. The core is high impact swaged to deform the wires and to make the wires brittle. The disclosed bullet fragments upon impact with a hard barrier such as a sheet of metal.

Disclosure of the Invention

A fully jacketed bullet is disclosed including a metal jacket and a core. The jacket has a base and a cylindrical body extending from the base. The core includes a plurality of strands of malleable material having a low shear modulus. The strands are helically formed or twisted together, and swaged into a uniform cylindrical shape. The core is seated into the jacket and the jacket is then point formed. The method disclosed includes providing a plurality of helically formed strands, swaging the strands to form a uniform cylindrical core, providing a jacket, seating the core in the jacket and point forming the jacket. The strands each have a uniform pitch around the core so that the shock wave that is created by the impact of the bullet and that travels longitudinally rearwardly along the bullet, uniformly and predictably shear fragments and disintegrates the strands.

Brief Description of the Drawings

Details of this invention are described in connection with the accompanying drawings that bear similar reference numerals in which:

Figure 1 is a side view of a bullet embodying features of the present invention.

Figure 2 is a perspective view of the core of the bullet of Figure 1 prior to swaging.

Figure 3 is a perspective view of the jacket and core of the bullet of Figure 1 after swaging of the core.

Figure 4 is a top view of the bullet of Figure 1 prior to point forming.

Figure 5 is sectional view taken through the line 5 - 5 of Figure 4.

Figure 6A is a side view of a core of a bullet with a plurality of strands parallel to the direction of travel.

Figure 6B is a side view of the fragmentation pattern of the bullet of Figure 6A upon impact.

Figure 6C is an end view of the damage track of the bullet of Figure 6A.

Figure 7A is a side view of a core of a bullet with two kinks in a plurality of strands.

Figure 7B is a side view of the fragmentation pattern of the bullet of Figure 7A upon impact.

Figure 7C is an end view of the damage track of the bullet of Figure 7A.

Figure 8A is a side view of a strand of a core of a bullet with a smoothly helically formed strands.

Figure 8B is a perspective side view of the fragmentation pattern of a core of a bullet having the strands of Figure 8A upon impact.

Figure 8C is a side view of the fragmentation pattern of the strand of Figure 8A upon impact.

Figure 8D is an end view of the damage track of the bullet of Figure 8A.

Detailed Description Of The Invention

Referring now to Figures 1 to 5, a bullet 10 embodying features of the present invention includes a jacket 11 and a core 12. As shown in Figure 2 the core consists of a plurality of strands 14, of a selected length, helically formed together in a spiral configuration so that each strand 14 extends rotationally around a longitudinal axis 15 of the core 12 and obliquely to the axis 15.

The strands 14 are made of a malleable metal. Metals having a low shear modulus are preferred. Lead, with a shear modulus of about 0.8 million pounds per square inch (psi) or lead alloy are preferred. Other suitable metals include tin and magnesium, both with a shear modulus of about 2.4 million psi, and aluminum, with a shear modulus of about 3.0 million psi. Less suitable metals include copper and zinc, each with a shear modulus in the range of 6 million psi.

The helically formed strands 14 of the core 12 are low impact swaged into a uniform cylinder 16 as shown in Figure 3. The term low impact swaging as used herein

refers to swaging metal through high pressure, such as in a low speed hydraulic press, rather than through a sudden, violent impact. Low impact swaging is distinguished from high impact swaging in that high impact swaging uses a sudden, violent impact to form metal. High impact swaging work hardens metal and makes metal brittle. The process of swaging bullets is known in the art, and well described in U.S. Patent 5,528,989, incorporated herein by reference.

Swaging the helically formed strands 14 of the core 12 provides a dynamically balanced core 12 with no voids for good flight performance. Prior to swaging the helically formed strands 14 of the core 12 have a mass slightly greater than the selected mass of the resultant cylinder so that excess material can be pushed out of bleed holes in the swaging die and the core 12 for each bullet 10 for a specific application will have exactly the selected mass.

The diameter of the combined helically formed strands 14 of the core 12, prior to swaging, is slightly less than the diameter of cylinder 16 and the length of the helically formed strands 14 of the core 12 is slightly longer than the cylinder 16. Swaging compresses the helically formed strands 14 of the core 12 so that the rotations per inch or pitch of the helically formed strands 14 of the core 12 increases.

The jacket 11 has a base 18 and an elongated, hollow, cylindrical side wall 19 of uniform thickness, attached to and extending transverse the base 18. The length of wall 19 is greater than the length of core 12. The base 18 and wall 19 form a cylindrical cavity 20 that is open opposite the base 18. The jacket shown has a flat base 18, however other configurations are suitable, such

as the rebated boattail. The diameter of the core 12 after swaging is slightly less than the diameter of the cavity 20 so that the core 12 may be readily inserted into cavity 20 and no air will be entrapped between core 12 and base 18 when core 12 is inserted into cavity 20.

As shown in Figures 4 and 5, the core 12 is seated in the jacket 11 against the base 18 after insertion of core 12 into cavity 20. The seating of core 12 includes pressing core 12 so that core 12 shortens and deforms outward to solidly contact wall 19. After the core 12 is seated in jacket 11, the bullet 10 is point formed such that the jacket 11, opposite base 18, has an inwardly tapering tip 21, as shown in Figure 1. The core 12 that extends into tip 21 will also be deformed into an inwardly tapering configuration by the point forming.

Figure 6A shows a bullet 30 with eight strands 32 that extend parallel to the direction of bullet travel. At impact the leading edge of bullet 30 is momentarily compressed. This compression induces a pressure wave that travels in the direction directly opposite the flight direction of bullet 30. Bullet 30 may have a velocity of about 3000 feet per second. The pressure wave travels at the speed of sound. The speed of sound in lead is about 4000 feet per second. Therefore, the pressure wave travels rearwardly the length of bullet 30 before bullet 30 penetrates the length of bullet 30.

The pressure wave separates the strands 32 as shown in Figure 6B. The pattern of the damage track for the bullet 32 shown in Figure 6A resembles an eight pointed star as shown in Figure 6C. The separation of bullet 30 into the eight strands 32 significantly reduces the penetration.

Figure 7A shows a bullet 40, similar to several prior known bullets, with eight strands 42 that extend generally parallel to the direction of bullet travel with each strand 42 having two kinks 43. The pressure wave created at impact travels parallel to, but in the opposite direction to, the direction of bullet travel. Strands 42, at the kinks 43, are not parallel to the direction of bullet travel. When the pressure wave reaches a kink 43, a shear stress is created in the strand 42. Strand 42 breaks if the shear stress exceeds the shear fracture limit.

As shown in Figure 7B, each strand 42 breaks at kinks 43 into three pieces, creating twenty-four fragments 44 from the eight strands 42. The damage track for the bullet 40 of Figure 7A is shown in Figure 7C and has twenty-four spokes. Since each strand 42 separates into three fragments 44, the penetration of bullet 40 of Figure 7A is significantly less than the bullet 30 of Figure 6A.

Figure 8A shows a smoothly helically formed strand 14 of the bullet 10 embodying features of the present invention. The strand 14 is continually oblique to the pressure wave, so the pressure wave produces shear stresses along the whole length of strand 14 and strand 14 separates at shear fractures 24 into many fragments 23, as shown in Figures 8B and 8C. The fragments 23 are more nearly uniform in size than prior known fragmenting bullets. Figure 8C shows the damage track of the bullet 10. The damage track has a diffuse uniform circular pattern. Since each strand 14 of bullet 10 separates into many fragments 23, the penetration of bullet 10 embodying features of the present invention is significantly less than the bullet 40 of Figure 7A.

The shear stresses increase as the angle of strand 14 increases relative to the direction of the pressure wave. The number of fragments 23 increases, and the size of the fragments 23 decreases and therefore the penetration depth decreases, as the pitch or turns per inch of the strands 14 increases. The number of fragments 23 also increases as the number of strands 14 increases. Between one half and five turns are suitable for the bullet 10, and between two and fifteen strands 14 are suitable for bullet 10. Since the fragments 23 are more uniform in size than prior known bullets, the penetration and impact pattern of bullet 10 are more predictable.

Bullet 10 has a full jacket 11 to minimize drag in flight and to assure that core 12 does not disintegrate prior to impact. Jacket 11 has a uniform wall thickness for balance. Similarly, core 12 is swaged into a uniform cylinder 16 for balance and further seated in jacket 11 for balance. Bullet 10 must be well balanced to prevent tumbling and disintegration before impact. Core 12 is preferably swaged into cylinder 16 before seating so that each bullet 10 will have a uniform selected precise mass. Jacket 11 and core 12 do not have incisions or grooves that would unbalance the bullet 10. Jacket 11 does not have grooves that would weaken the jacket 11 and cause the jacket 11 to burst from the pressure required to seat core 12.

The method of making the bullet 10 includes the steps of providing a plurality of strands helically formed together in a spiral configuration, low impact swaging the strands into a cylindrical core with the strands maintaining the spiral configuration, providing a cylindrical jacket with a closed base, seating the core

into the jacket, and point forming the jacket opposite the base.

Although the present invention has been described with a certain degree of particularity, it is understood that the present disclosure has been made by way of example and that changes in details of structure may be made without departing from the spirit thereof.